Interpretation of ambiguity in depression

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Highlights

- Research on biased and inflexible interpretations in depression is reviewed
- Mechanisms underlying interpretation processes in depression are discussed
- Pathways from interpretation processes to depression are presented
- Directions for clinical applications are outlined

Abstract

Distorted interpretations of ambiguous information have been theorized to confer risk to experiencing depression. This article discusses recent research characterizing biased and inflexible interpretation processes to resolve ambiguous situations in depression, its underlying cognitive mechanisms, and potential pathways to depression. Future research directions are outlined to consolidate the understanding of the nature, causes, and effects of interpretation processes in depression to advance psychological treatments for this burdensome mental health condition.

Keywords: Depression, Interpretation Bias, Interpretation Inflexibility.

Interpretation of ambiguity in depression

Everyday life is replete with ambiguity, especially when it comes to social situations. For example, you may notice a colleague frowning when you voice your opinion during a meeting and wonder: "Was it because he disagreed with me or because he was thinking about his packed work schedule?". At noon, you might notice that this colleague did not join you for lunch and thought: "Is he avoiding contact with me or simply skipping lunch to catch up on work?". To understand what is happening in such ambiguous situations, people need to generate and select plausible interpretations that resolve its ambiguous nature (Blanchette & Richards, 2010; Huppert et al., 2007). How ambiguous situations are interpreted has major consequences for people's mood and behavior (Hirsch et al., 2016). Understanding how people resolve ambiguity and how this process of interpretation goes awry seems critical to understanding and treating prevalent mental health conditions such as depression.

How do individuals with depression interpret ambiguity?

Contemporary clinical theories posit that interpretation bias plays an important role in the onset and maintenance of depression (Beck & Haigh, 2014; Holmes et al., 2009; Ingram, 1984; Mehu & Scherer, 2015). Interpretation bias refers to a tendency to infer more negatively-valenced and less positively-valenced interpretations to explain ambiguous information (Beck & Haigh, 2014). In the example above, a person may think: "my colleague finds my ideas stupid and does not want to have lunch with me". This hypothesis has generated a large body of empirical research using a variety of innovative paradigms in samples of individuals with subclinical, clinical, and remitted depression. However, though the theoretical hypothesis is straightforward, empirical research has produced mixed findings (for reviews, see Blanchette & Richards, 2010; Gotlib & Joormann, 2010; LeMoult & Gotlib, 2018; Wisco, 2009). Synthesizing observations from 87 empirical studies, a recent comprehensive meta-analysis reported a moderate overall effect size supporting the theorized interpretation bias in depression

(Everaert, Podina, et al., 2017). Results indicated that depression is associated with both decreased positive and increased negative interpretations of ambiguity. Furthermore, the meta-analysis found equivalent effect sizes for studies in individuals diagnosed with major depression, individuals reporting elevated depressive symptom levels, and individuals remitted from clinical depression. This suggests that interpretation biases operate across subclinical and clinical forms of depression and persist beyond a depressive episode. Going beyond cross-sectional data, research has shown that interpretation bias occurs in never-disordered offspring of parents with a history of depression (Dearing & Gotlib, 2009; Sfärlea et al., 2019), causally influences critical depressive symptoms (Fodor et al., 2020; Menne-Lothmann et al., 2014), is stable over time (Creswell & O'Connor, 2011), and predicts future depression levels (Normansell & Wisco, 2016; Rude et al., 2002, 2010). Collectively, the available evidence suggests that interpretation bias confers risk to experiencing depression.

While research has made important strides in characterizing interpretation biases related to depression, it remains unclear how this putative cognitive risk marker exerts its toxic effects. Traditional clinical theories view interpretation bias as an inherently maladaptive process. Yet, emerging "flexibility" perspectives on mental health challenge such static views (Kashdan & Rottenberg, 2010; Mehu & Scherer, 2015; Stange et al., 2017) and emphasize that an interpretation bias may not always (mal)adaptive (Everaert et al., 2018). Negative interpretations may motivate people to adjust their behavior (e.g., tactfully voicing your opinion at work) and positive interpretations may lead people to ignore negative situations (e.g., problems at work). Whether interpretations promote (mal)adaptation depends on the fluctuating demands of the context in which these interpretations are made (Kashdan & Rottenberg, 2010; Mehu & Scherer, 2015; Stange et al., 2017). Independent of the content of interpretations, the inflexibility with which emotional interpretations are formed and maintained may determine the misfit with situational demands, thereby increasing risk for depression (Everaert et al.,

2018). To test this novel hypothesis, researchers have developed a novel cognitive task measuring how people adjust their initial emotional interpretations on the basis of novel disconfirmatory information (Everaert et al., 2018). Consistent with the theoretical prediction, three independent studies have shown that greater depression severity is not only associated with elevated negative interpretations but also by reduced revision of negative interpretations in the face of disconfirmatory positive information (Everaert et al., 2018; Everaert, Bronstein, et al., 2020). These initial findings suggest that depression features both biased and inflexible negative interpretations of ambiguity.

Which mechanisms drive the interpretation of ambiguity in depression?

Inferring interpretations to resolve ambiguity is a higher-level cognitive operation that is expected to rely on as set of basic attention and memory processes. In depression, negative biases of attention and memory may contribute to the skewed generation and selection of interpretations by influencing how people seek and integrate information. Emerging research examining interactions between cognitive biases in depression is generally consistent with this notion (Everaert, Bernstein, et al., 2020). Various studies have shown that biased attention toward negative stimuli predicts higher proportions of negative interpretations in individuals with more severe symptoms of depression (Everaert et al., 2014; Sanchez et al., 2015). Yet, no evidence has been found for the reverse effect of interpretation bias on attention. In a recent study (LeMoult et al., 2017), adolescents suffering from clinical depression completed a cognitive training procedure to induce a positive bias when resolving ambiguous information. The impact of this experimental manipulation on attention bias was examined. Though the cognitive training procedure successfully induced a positive interpretation bias, no transfer of the training occurred to the attention bias task.

With respect to memory processes, current research suggests that working memory difficulties are involved in how people with depressive symptoms interpret ambiguous

information. In particular, recent work suggests that both difficulties in shifting between emotionally negative working memory representations and updating of working memory to discard negative representations are uniquely related to depression-linked interpretation biases (Everaert, Grahek, & Koster, 2017). In that study, both shifting and updating difficulties had an indirect effect on depression severity through negative interpretation bias. In addition, there is evidence suggesting that long-term memory recall is affected by interpretation biases (Everaert et al., 2014). A study in clinically depressed individuals modified interpretation biases through experimental manipulation to examine the impact on long-term memory (Joormann et al., 2015). The results showed that an induced positive interpretation bias resulted in more positive interpretations and improved recall of these interpretations on a memory test.

Together, current evidence suggests that attention biases filter negative information in the environment to modulate the interpretation of ambiguity. Yet, interpretation biases may in turn not guide attention toward congruent information in the environment. Furthermore, working memory difficulties may modulate the information that is considered when interpreting ambiguity and these biased interpretations may then be stored in long-term memory, setting the stage for recall biases linked to depression. Unfortunately, similar research on cognitive mechanisms in interpretation inflexibility is missing. Yet, difficulties in working memory operations seem particularly relevant to understand inflexibility when initial negative interpretations are violated by novel positive information. In this respect, future work could explore the role of impaired conflict monitoring during reasoning in guiding working memory operations and (inflexibly) interpreting ambiguity (Bronstein et al., 2019; Grahek et al., 2018).

In addition to research on attention-memory bias interactions involved in interpreting ambiguous information, an area of ongoing investigation aims to characterize the automaticity of processes contributing to ambiguity resolution in depression. In particular, this research examines whether emotional biases in depression are formed by automatic (i.e., unconscious,

effortless, unintentional, uncontrollable) and/or controlled (i.e., conscious, effortful, intentional, controllable) processes (Beevers, 2005; Teachman et al., 2012). While studies have provided relatively consistent evidence for interpretation biases at controlled processing levels (Wisco, 2009), the evidence for automatic processes in interpretation biases is less straightforward. To investigate automatic features of interpretation biases, studies typically employ paradigms measuring behavioral (e.g., reaction times) or psychophysiological (e.g., startle reflexes) responses to emotional interpretations as indirect indices (e.g., Bisson & Sears, 2007; Lawson et al., 2002; Mogg et al., 2006). However, meta-analytic evidence indicates that studies using such indirect measures have not provided reliable evidence for interpretation biases in the context of depression (Everaert, Podina, et al., 2017). There is substantial heterogeneity among effect sized reported by studies using indirect measures, rendering conclusions about the utility of such measures to study automatic features of interpretation biases difficult. Indeed, some paradigms may be better suited to study automatic processes contributing to interpretation biases. In this respect, more recent semantic association paradigms seem more reliable in illuminating automatic features of interpretation biases in depression (Bianchi & Nogueira, 2019; Cowden Hindash & Rottenberg, 2017a). In moving forward, studies could build on the methodological advances to identify boundary conditions of automatic interpretation biases and determine the correspondence between automatic and controlled features to understand the processes driving interpretation bias and inflexibility.

How do the ways people interpret ambiguity engender depression?

Biased and inflexible interpretations of ambiguity may increase risk for depression by dysregulating emotional responding and emotion regulation (Mehu & Scherer, 2015). Several studies have investigated the causal impact of interpretation biases on emotional responding. This research has used cognitive training methods to manipulate interpretation biases and test how the induced biases are related to responses on a stress induction task. Current findings

suggest that induced positive interpretation biases are related to smaller increases in heart rate during the anticipation of a social-evaluative speech task (Joormann et al., 2015) as well as more positive and less negative emotions following a failure task (Cowden Hindash & Rottenberg, 2017b). Positive interpretation biases may thus have a benign influence on stress reactivity. However, still little is known about how emotional disturbances in ambiguity resolution predict problems in the dynamic unfolding of emotions in daily life (Houben et al., 2015; Kuppens & Verduyn, 2017). A highly interesting avenue for future research is to explore whether inflexible negative interpretations consistently evoke similar negative emotions (e.g., sadness) regardless of the past and current attributes of a situation, thereby setting the stage for higher levels of stability in elevated negative and blunted positive emotions in depression.

There is increasing research that aims to uncover how biased and inflexible negative interpretations of ambiguous information are involved in initiating and perpetuating the maladaptive pattern of emotion regulation strategy use characteristic of depression (Joormann & Stanton, 2016; Joormann & Vanderlind, 2014). Cross-sectional studies have repeatedly shown that interpretation biases are associated with higher levels of rumination and lower levels of positive reappraisal in subclinical and clinical forms of depression (Everaert, Grahek, Duyck, et al., 2017; Krahé et al., 2019; Mor et al., 2014; Wisco et al., 2014). Going beyond cross-sectional data, a recent study tested whether a negative interpretation bias may causally influence rumination (Hirsch et al., 2018). It was found that inducing positive interpretations through cognitive training resulted in a reduction of rumination as well as depressive symptoms. This finding suggests that interpretation processes may be causally linked to some of the key emotion regulation difficulties in depression.

Research has expanded on this work and started to investigate the role of inflexible negative interpretations in emotion dysregulation. Across two studies (Everaert, Bronstein, et al., 2020), researchers observed that inflexibility in revising negative interpretations based on

novel positive information was related to dampening of positive emotions, but not rumination or positive reappraisal. Interestingly, such dampening appraisals (e.g., thoughts such as 'I don't deserve this) mediated the relation between inflexible negative interpretations and symptoms of depression (even after controlling for interpretation bias). This initial work suggests that inflexibility in revising negative interpretations based on positive information may explain some of the difficulties in regulating positive emotions in depression. However, future longitudinal research is required to establish directional effects of interpretation inflexibility on dampening and depression severity.

How people interpret ambiguous social events may not only affect their regulatory attempts, but also impact how they navigate the social world. Research shows that depression is characterized by problems in socio-affective functioning, including decreased social engagement, quarrelsome behavioral tendencies as well as interpersonal stress and problems (Hames, Hagan, & Joiner, 2013; Rappaport, Moskowitz, & D'Antono, 2017). From a stress generation perspective (Liu & Alloy, 2010), it seems plausible that inflexibility in revising negative interpretations highlights negative aspects of positive social experiences, thereby encouraging context-inappropriate social behaviors (e.g., keeping others at a distance, decreased social engagement) that may provoke negative reactions from others (e.g., arguments with friends). Frequent occurrence of such social stress may in turn fuel inflexible interpretation of ambiguity, erode relationships, and trigger depressive symptoms over time. It is remarkable that research to-date has yet to elucidate the interpersonal dynamics related to interpretation processes in depression. This provides a promising avenue for future research.

What are ways to improve psychological treatments?

Efforts to advance the understanding of interpretation processes in depression seem integral to improve existing treatment strategies. This is because interpretation processes form a central target in many psychological treatments such as cognitive-behavioral therapies (Beck

& Haigh, 2014) and cognitive training programs (Fodor et al., 2020; Menne-Lothmann et al., 2014). These treatment strategies incorporate various techniques (e.g., cognitive restructuring, reappraisal) that depend on interpretation flexibility and processing of disconfirming information to modify dysfunctional beliefs about the self and others. In this respect, the increasing focus on dynamic properties of cognitive biases (i.e., inflexibility or context-insensitivity; e.g., Everaert et al., 2018; Kashdan & Rottenberg, 2010; Stange et al., 2017) represents a theoretical innovation with potentially important clinical applications to improve the limited efficacy of current treatment strategies (Cuijpers et al., 2010).

One particularly interesting direction for research is to test the utility of biased and inflexible interpretations as markers of treatment success. It is plausible that individuals with more severely biased and inflexible interpretations are at risk of poor treatment response and dropout. In an attempt to increase flexibility, interventions may benefit from a focus on facilitating the intake and integration of disconfirmatory positive information into existing negative beliefs (as opposed to merely providing corrective or belief-disconfirming experiences). Strategies to facilitate updating of negative interpretations may involve methods that increase awareness of attention allocation to promote the salience of belief-incongruent (positive) information (Bernstein & Zvielli, 2014; Sanchez et al., 2019) and methods that reduce dampening appraisals of positive information that is incongruent with negative interpretations (Vanderlind et al., 2020). Though research is at the early stages, studying the utility of interpretation processes in predicting treatment outcomes may open up exciting lines of research that could eventually provide insights that help to reduce the burden of depression.

Conclusion

Uncovering the nature, causes, and consequences of emotional disturbances in interpreting ambiguity may be important to understand and treat depression. Research has made important progress in identifying the nature of biased and inflexible in interpretations in

depression, its underlying cognitive mechanisms, as well as associated difficulties in emotional responding and regulation. Yet, there remain open questions that currently challenge our understanding of how biased and inflexible interpretation operate in depression. This article may help to synthesize current research and serve as a starting point for future research on interpretation processes to advance theories and treatments of depression.

Declaration of interest

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